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## A Sustainability Assessment of Advanced Materials for Novel Housing Solutions

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### Abstract

Material selection is a key step in product design and typically aims at identifying the most suitable material that meets product performance goals at minimum cost. In recent years research has been driven for developing sustainable solutions at competitive costs. This work evaluates the sustainability of advanced sandwich-structured composites for novel housing solutions. Five polymer matrix composite sandwich materials have been selected and compared concerning mechanical, thermal, acoustic and fire performance as well as cost and environmental impact, in order to study both the technical viability and the sustainability of lightweight solutions for prefabricated structural wall panels as well as for new housing; this included mechanical and fire testing of the selected materials. Subsequently, the thermal and acoustic properties of the alternatives were obtained. After performing a cost analysis and environmental assessment, the results of the tests and analyses led to a multi-criteria decision analysis (MCDA); PROMETHEE II (preference ranking organizational method for enrichment evaluation) was used to identify the best alternative. Finally the proposed solution was compared with a typical brick house performance. Higher specific strength, better thermal insulation and lower environmental impacts arose as the main advantages of the proposed structures while acoustic properties and fire safety still need to be improved.

**Keywords:** Environmental impact; life cycle assessment; sandwich panel; sustainable building; ReCiPe; PROMETHEE II

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